THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION'S ROLE AS IT AFFECTS INSTRUMENTATION DEVELOPMENT

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(Presented at the Symposium of All Inter-Range Instrumentation Group, Monterey, California, October 10, 1958)

Reprint

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I am very glad to have been able to keep my commitment to you to discuss with you NASA's role and programs as they affect range planning and instrument development. This occasion gives me the opportunity of thanking you for your cooperation in the past with the former NACA and of asking for your support in meeting the far more extensive and difficult problems of the National Aeronautics and Space Administration which came into existence just ten days ago.

I will briefly describe the NASA, its functions and organization, and the general features of its immediate program, and then discuss various aspects of range use and instrumentation as they appear to us in these early formative stages of NASA.

The basic legislation establishing the NASA was passed by the last Congress and signed by the President on July 29, 1958. It is known as the National Aeronautics and Space Act of 1958. On August 8th Dr. T. Keith Glennan, President on leave from Case Institute of Technology

was appointed Administrator and I was appointed Deputy Administrator, by the President. Our appointments were confirmed by the Senate on August 15th, and we were sworn in on August 19th.

The nucleus of the new agency was the former NACA with its 8000 employes, 3 major laboratories, High Speed Flight Station, and Wallops Island station valued at more than 350 million dollars. The Act provided that NACA would cease to exist and all its functions, powers, duties and obligations, property, personnel, funds and records would be transferred to NASA when the Administrator announced by proclamation that the NASA had been organized and was prepared to discharge the duties and exercise the powers conferred upon it by the Act. This proclamation was made on September 25th announcing the effective date at the close of business on September 30th.

The functions of NASA were stated in very broad terms as the planning, direction, and conduct of aeronautical and space activities defined as (A) research into, and the solution of, problems of flight within and outside the earth's atmosphere, (B) the development, construction, testing, and operation for research purposes of aeronautical and space vehicles, and (C) such other activities as may be required for the exploration of space. Aeronautical and space vehicles are further defined as aircraft, missiles, satellites, and other space vehicles, manned and unmanned, together with related equipment, devices, components, and parts.

The declaration of policy in the Act states that "such activities shall be the responsibility of, and shall be directed by, a civilian agency exercising control over aeronautical and space activities sponsored by the United States, except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including the research and development necessary to make effective provision for the defense of the United States) shall be the responsibility of, and shall be directed by the Department of Defense".

The Act establishes a National Aeronautics and Space Council in the Executive Office of the President to advise the President with respect to the performance of the duties assigned to him by the Act. These include a survey of all activities of all agencies of government, to develop a comprehensive national program, designate and fix responsibility for direction of major activities, and resolve differences. The Council held its organizational meeting on September 24th. The members of the Council are the President, who presides over meetings, the Secretary of State, the Secretary of Defense, the Administrator of NASA, the Chairman of AEC, Dr. Alan Waterman, who is the Director of the National Science Foundation, Dr. Detlev Bronk who is president of the National Academy of Sciences, Dr. James Doolittle, and Mr. William Burden.

The Administrator of NASA has announced the general features of the initial organization of NASA. The line organization will consist of three major parts, one dealing with space flight development and operation,

the second with aeronautical and space research, and the third with business administration.

Mr. Abe Silverstein, formerly Associate Director of the NACA Lewis Flight Propulsion Laboratory (now renamed NASA Lewis Research Center) has been appointed Director of Space Flight Development. The work of this part of the organization will be conducted largely by contract with existing organizations in government, industry, and universities. The Wallops Island Station of NACA becomes a field activity of this group, as does a Space Flight Center to be located at Beltsville, near Washington. At Beltsville will be located the Vanguard group recently transferred to NASA by executive order, the project and contract monitors, and a data reduction center.

The aeronautical and space research group comprises essentially the former NACA research laboratories and stations with the exception of Wallops. Mr. John W. Crowley, Jr., previously Associate Director of NACA, has been appointed Director of Aeronautical and Space Research, and Dr. Henry Reid, Dr. E. R. Sharp, Dr. S. J. DeFrance, and Mr. Walter Williams have been appointed to head the Langley, Lewis, and Ames Research Centers and the High Speed Flight Station, respectively.

Mr. Albert Siepert, formerly Executive Officer of the National Institutes of Health, has been appointed Director of Business Administration.

At the top level, reporting directly to him, the Administrator has appointed Mr. John Johnson, formerly General Counsel of the Air Force, as General Counsel of NASA and Mr. Walter Bonney as Public Information Officer. There has also been established at this level as a staff activity an Office of Program Planning and Evaluation, whose director, a prominent space and propulsion scientist will shortly be named.

It should be clear from what I have said that NASA is a new agency with greatly increased responsibilities and completely new functions as compared with the older NACA which it absorbs. By direction of the President NACA did some advance planning which formed the basis of the initial organization and program. Both organization and program are being reviewed and firm decisions made very rapidly, but I am not able tonight to draw for you a detailed organization chart or to describe the program in specific detail. Specific projects are going forward, and we will in the near future establish liaison offices at the Atlantic and Pacific Missile Test Ranges.

The Act provides that the President, for a period of four years after the date of enactment of the Act, may transfer to the NASA any functions (including powers, duties, activities, facilities, and parts of function) of any other department or agency of the United States which relate primarily to the functions, powers, and duties of the Administration. Under this authority the President has transferred the Vanguard project from the Navy, the lunar probe and scientific satellite projects from the Advanced Research Projects Agency of the Department of

Defense, certain large booster and high energy rocket projects from the Air Force, and the support of AEC's Rover nuclear rocket program from the Air Force. These programs are in many cases well along the road to completion, in others just beginning and represent a large part of NASA's immediate operational program. No major changes are likely to be made in these programs which are near completion or in their executive direction.

The Act provides broad powers for using the talents and resources of all types of agencies whose services are needed. We are studying the best methods of utilizing these skills and there may be additional transfers of functions.

The space program of NASA includes the five major areas which are found in nearly all recommendations for a national program, namely research, both basic and applied, to advance space technology and support practical developments, development of components to permit an increasing space flight capability in the future, development of satellites for immediate practical applications, unmanned exploration of space to advance our knowledge of the earth and planets, of the vast regions of space around us, and of the whole universe, and the direction of applied research and technology toward early manned exploration of space.

The basic and applied research will be carried out in part at the existing NASA research centers, and in part by contract with qualified groups elsewhere. The activities of the present centers are largely in the fields of aerodynamics, propulsion, and structures. The task before

NASA requires research in these and many other scientific and technical areas. Wherever possible, expansion of the research program will be accomplished by contract.

The second area is that of practical component development to increase our capabilities in space exploration. The NASA program includes the development of a rocket booster with thrust of the order of 1 to 1.5 million pounds, the development of upper stages using high energy propellants, support of the development of nuclear propulsion, research and development directed toward ion and other forms of electric propulsion. It includes the practical development of sources of power for operation of equipment and measuring devices within the satellite, such as scientific apparatus, orbit controls, communication equipment, environmental control, etc. It includes a program for guidance and control and communication equipment to meet the needs of foreseen missions.

The third area is that of immediate practical applications of satellites for peaceful uses. Here it is possible to design and launch satellites for weather observations and other meteorological research and satellites for long-distance communication.

The fourth area is the use of satellites in increasing scientific knowledge of the environment of space, the planets, and of the universe. This activity represents a continuation of the IGY program and NASA has already received the specific recommendations of the National Academy of Sciences Space Science Board for the experiments that should be immediately undertaken.

The final area is that of advanced space technology looking toward early experience with man in a satellite making a few orbits around the earth. This program is a cooperative one with the Department of Defense with NASA being responsible for the technical management.

I realize that such a general description does not convey to you in detail the information required for range planning. You must be patient with us until these details are in hand. We can tell you that the boosters to be used by NASA within the next few years will be Jupiters, Thors, and Atlases, later Titans, that the missions will be satellite and space probe missions, that the firings will be made at the Atlantic and Missile Test ranges, that the currently available funds do not permit any radical increase in rate of firing. Future forecasts will depend most on the rate at which the nation wishes to advance, which we hope will soon be determined by the National Aeronautics and Space Council. As the program gains momentum, substantially greater funds will be required if we are to become a leader in space technology.

The NASA is taking over with the Vanguard project under the recently issued Executive Order the IGY network of tracking stations, electronic, optical, and Moonwatch, and will build on this base. The Executive Order also transfers the facilities associated with the lunar probe programs of ARPA. I am sure that you will be interested in our thinking on the ground environment system for NASA. To describe this I will backtrack a little in time.

In 1957 the NACA established a Special Committee on Space Technology under the chairmanship of H. Guy Stever with an instruction to recommend a national civil space research program. The Committee established a number of working groups of which at least three are of interest to you. These are the Working Group on Range, Launch, and Tracking Facilities, the Working Group on Space Surveillance, and the Working Group on Instrumentation. This committee and its working groups were reconstituted as Advisory Committees to the Administrator, NASA, for the purpose of completing their report. The reports are now in draft form. I consider them outstanding although they were not completed in time for consideration by NACA and I cannot say at this time whether NASA will follow their recommendations. I hope that we can make copies available to you by the end of this calendar year.

I will read you the conclusion of the Working Group on Range, Launch, and Tracking Facilities as expressed in the current draft prepared with the assistance of the working groups on space surveillance and instrumentation:

"Domestic Range Capability - The only national ranges capable of launching satellites, the Atlantic and the Pacific Missile Ranges, are described in sufficient detail to indicate their present and potential capabilities in support of the National Space Research Program. These facilities are considered adequate for major satellite launchings from continental United States.

"Equatorial Launching Site - An equatorial launching site for satellites and other space vehicles offers unique and substantial advantages. The associated logistic problems, however, are severe. Therefore, it is recommended that the NASA support a serious study to determine whether it is in the national interest to establish such a base system. Both fixed-base and task-force type systems should be considered.

"Communication System - The communication system for programs involving real-time computation and operation of satellites and space vehicles is a limiting factor on the nature of the operations which may be undertaken. Therefore, an integrated system-development program should be planned and actively pursued, on the basis of carefully established national requirements for real-time and small-delay communication capabilities. Realistic requirements and maximum system utilization will be impossible without close coordination both of existing projects and of new project planning.

"Instrumentation - A research and development program for instrumentation to improve tracking, communication and computation capabilities should be assured of adequate long-term support. Advancement of the state of the art on a broad front is consistently more satisfactory than isolated crash programs in critical areas.

"Recovery System - The requirements for recovery of instrumented and manned satellites from orbital flight pose equipment, communication, and operational problems which are of very great magnitude. The escape maneuver during both the launch and the recovery phases

will require recovery capability over large areas of the Atlantic Ocean, the Pacific Ocean, and possibly the United States Zone of the Interior. It is recommended that the Atlantic, Pacific, and White Sands Missile Ranges establish coordinated operational groups for these three areas, making maximum use of existing organization and facilities, for all national space programs requiring recovery techniques."

The working group was presented with certain management concepts which represented the thinking of the NACA in early 1958. The present ideas of NASA are essentially the same although there has been no specific approval of this statement and it may be modified in some of the details. The original statement was as follows:

"In accordance with its charter, NASA will conduct a civilian space flight program in the fields of space science, manned space flight, and advanced applications of space technology. The program contemplates the use of military, industrial, and scientific groups competent in the field under the management and support of NASA. The existing DOD ranges and their facilities will be utilized and provided with technical support and project funding as required. The Wallops Island range facilities will be utilized and expanded for special work in techniques and components in support of the program. The existing IGY tracking and computing facilities will be supported and supplemented in coordination with other applicable systems for the greatest mutual advantage. New tracking and communication systems are to be employed when existing systems are inadequate, overloaded, or where serious interference would otherwise occur.

"An active program for exploring the needs of the future such as a new launching site (equatorial), and advanced instrument systems and range techniques will be pursued.

"Other future developments may require laboratory support installations for the NASA mission at the Department of Defense ranges in addition to the initial liaison and coordinating groups."

The press accounts of the Wallops Island plans have created an erroneous impression through the use of the term "the Cape Canaveral of the NASA". Wallops will be used for what I have termed the one-ton truck jobs as compared with the 20- or 30-ton truck projects. Specifically, improvements will be made to improve operating performance by substituting a causeway for the present ferry boat, removing housekeeping to the mainland to increase safety and permit use of high energy fuels, provide adequate radar tracking devices for high-speed long-range ballistic flights of models, and to provide a capability of launching small satellites with solid propellant rocket systems. The present frequency of long-range firings is not expected to be substantially increased except as accomplished by more firings on the same day.

I will close with a few statements about my own personal views with respect to the required tracking and communications network. I believe that the surveillance of objects in the sky orbiting the earth will be essential to the operation of any anti-ballistic missile defense system. I believe that this is a military responsibility and that the world-wide net required for this purpose should be constructed and managed by an agency of the

Department of Defense. On the other hand I believe that NASA must be responsible for the apparatus and equipment receiving signals sent from its own satellites and space probes and for the handling of the data. This does not mean that I favor two independent world-wide networks. Wherever possible there should be multi-purpose siting and common ground communications. NASA apparatus should be located where practicable at DOD sites to avoid the necessity of duplicate housing and logistics and there should be a free exchange of data, but the telemeter and communication receivers for the satellite transmitters should be manned by personnel responsible to and under the control of NASA. For technical reasons a common location may not always be possible so that there must be exceptions. This concept has been agreed to in principle by the Deputy Secretary of Defense.

I should like to close by emphasizing two points. First it is clear that satellite projects do not represent undertakings which can be confined to a single missile range. They are essentially world-wide in scope and the functions of the missile range relate primarily to the initial launch and placing in orbit and in later stages of the program in the recovery operation. I have already noted our working group's recommendation that ranges prepare for the recovery mission.

Finally I should like to emphasize that the receiving, communicating, and data handling procedures must be so designed and operated that peculiarities or anomalies in the data do not get lost in an automated mass production operation. Some of you may have seen some of Van Allen's

records which led to the discovery of the radiation belt. It took the sharp eye of an assistant who had studied and was familiar with many records to perceive anything unusual.